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Biology of a praying mantid *Tenodera attenuata* (Stoll, 1937) (Mantodea: Mantidae: Mantinae) from Sindh

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Abstract

Praying mantids are famous as pitiless predators and they attack surprisingly within seconds hence called as ambush predator. The biology of Praying mantids has been discussed quite rare; therefore, present study was designed behind the assortment and identification of Oothecae, collected from various localities of Sindh during May to November 2013-2015. The morphometrics results identified 45 specimens and 23 Oothecae of *T. attenuata* generally in the laboratory, field and in green house. The total number of hatchings 232.8 ± 18.33 and birth rate% 71.23 ± 12.77 were counted whose total length and width 17.84 ± 0.49 mm and 11.84 ± 0.42 mm was measured. The first nymphal stage was measured about 11.00 ± 0.25 mm in length with a total duration of 12.6 ± 1.14 days; however, the fifth nymphal stage was measured about 57.10 ± 1.89 mm in length with a total duration of 53.2 ± 1.78 days. Highest mortality was recorded between 1st to 3rd instars. Female survived 165.4 ± 08.10 days and has elongated longevity than male. Both, temperature and humidity were measured by Digital Thermal hygrometer TH302. Photographs were captured by digital Samsung 14.5 mixa pixel camera.

Keywords: Mantids, Hatching, Oviposition, Fecundity, Longevity, Feeding, Mating

1. Introduction

Praying mantids are lions of the insect's world, like lions they are active and ferocious predators, and like, lioness most hunting is attempt by female praying mantid, but unlike lions praying mantids never wait for the death of victim hence they are famous as pitiless predators. Praying mantids assault is the surprise attack within a part of a second without moving the whole body hence also called ambush predator, feeding principally on the diversity of insects, arthropods and rarely on small vertebrate. Being a predator in nature they have carnivorous type of mouthparts^[1, 2]. Mantids belong to the top predators of the arthropod community. Some species wear cryptic colours and resemble leaves, flowers, sticks or bark. Mantids are characterized by their highly specialized raptorial forelegs and a mobile head with powerful compound eyes that allow for binocular sight. Phylogenetically, they are placed in the vicinity of termites and cockroaches, with which they form the superior taxon Dictyoptera^[3]. In spite of their size and often-spectacular appearance, surprisingly little is known about the biology of praying mantids. However, numerous studies concerning their physiology, neurology and behaviour do exist - most of them focusing on visual performance, and defensive, courtship and feeding behavior^[4]. Mantids are also used as model organisms in studies on predator's behaviour and strategies^[5]. In spite of several parameters of research done on praying mantids occurring in the world, the biology, hatching, feeding, mating, oviposition, fecundity and longevity still fully or partially is unresolved. This is the first time all above modes have been recognized in biology of *Tenodera attenuata*. Foremost this species occurring throughout the Sindh province and grow huge and feed many insect pests in comparisons of other species of praying mantids.

The present exploration will not only provide a dense foundation for studies leading to a rather more promising field-Biological control of insect pests but is also important from a purely academic point of view. The work all over reported on mantids is fair but diverge by several researchers like^[1, 2, 6-23], but the present work is illustrious and first time reported.

2. Materials and Methods

The present study was conducted in the Post Graduate lab of Taxonomy, Department of Zoology, University of Sindh, Jamshoro from May to November 2013-2015 to find out the parameters like hatching, feeding, mating, oviposition, fecundity and longevity of mantid, *Tenodera attenuata* (Stoll, 1937).

2.1. Collection of material: The Biology of a mantid, *Tenodera attenuata* (Stoll, 1937) was premeditated behind the assortment and identification of Oothecae, which were collected from various localities of Sindh during the months May to November, in 2013-2015.

2.2. Preservation and Rearing: The collected samples were kept at an average 26.2 ± 0.47 to 38.78 ± 0.47 °C day and night temperature and relative humidity 62.6 ± 0.55 to 82.6% in the aerated transparent glass houses above covered with fine mesh nylon cloths in the lab. The glass houses were finished bushy and muddy as compared with the natural habitats of praying mantids.

2.3. Study of effect: After hatching the nymphs were transferred in other glass cages in the same way (4 feet length, 2 feet width and height) where all parameters; hatching, feeding, mating, oviposition, fecundity and longevity were documented. A bulb was maintained for day and night temperature, during cold it was brought closer to cage while during warm temperature it was fixed on distant or switched off.

2.4. Image analysis and Abiotic factor measurement: Temperature and humidity, both were measured by Digital Thermal hygrometer TH302. Photographs were captured by digital Samsung 14.5 mega pixel camera.

2.5. Statistical analysis: The measurements were taken and represented through descriptive statistics, (Statistical software SXW 8.0).

3. Results and Discussion

The present study was subjected to find out the biology of mantid, *Tenodera attenuata* (Stoll, 1937).

Explanations to Genus *Tenodera* (Burmeister)

Diagnosis: The range rather to very large; elongate, but rather robustly built; facial shield about twice as broad as high; pronotum moderately long but quite stout in the commonest species, only feebly broadened at the transverse sulcus; lateral margin of females finely serrate; tegmina and hind wings fully developed, tips sub-acute; fore-legs stout, lower margin of coxa strongly toothed; middle and hind femora each with an apical spine; (green coloration of tegmina sharply limited to anterior area; fore coxa without black- ringed spot).

Explanations to *Tenodera attenuata* (Stoll) 1937.

Male: Size very long, slender; eyes round; head twice as broad as high with anterior margin arched; pronotum extremely long and narrow; bicarinate with well-defined carinae granulose in front of transverse sulcus and strongly

carinate behind; fore-legs stout, lateral margin of coxa with row of alternate small and large tubercles; mid and hind femora each with two apical spines; tegmina and wings fully developed but abbreviated and shorter than the abdomen; tegmina narrow; cerci long, stout; styli short. Female: Similar to male except in size.

Coloration

Brown with green patches; hind wings much pale.

Distribution: India, Pakistan and China

Explanations to the present study.

Over 2,400 species of mantis in about 430 genera are recognized [24]. They are predominantly found in tropical regions, but some live in temperate areas [25, 26]. Larger mantises sometimes eat smaller individuals of their own species [27]. Oothecae are often found on exposed parts of tree trunks or branches and human-made structures such as fences and posts [28] and tend to be on trees with unshaded trunks [29]. Morphometrics study of assorted and identified 45 specimens and 23 Oothecae of *T. attenuata* generally in the laboratory, field and in green house while 5 healthy oothecae of *T. attenuata* were kept for the examinations. Specimens were processed according to standard entomological methods and oothecae measured in mm. The total length and width of oothecae was 17.84 ± 0.49 mm and 11.84 ± 0.42 mm measured respectively. However, the total number of hatchings 232.8 ± 18.33 and birth rate% 71.23 ± 12.77 were measured (Table.1). The hatchings were kept in glass houses above covered with fine mesh nylon cloths. The glass houses were finished bushy and muddy as compared with the natural habitats of praying mantids (Fig.1, 2). Average temperature and humidity was adjusted between 26.2 ± 0.47 to 38.78 ± 0.47 °C, humidity 62.6 ± 0.55 to 82.6% (Table.2). After a few days nymphs hatched from compartment of oothecae which is a one way valve like space (Fig.3,4,5) and hatchling or Nymphs were looked famished and somewhat like red ant. To get an experience of the outside air for the first time; they hang around the egg case for a little duration, same as spider-lings, moreover, a few cases of cannibalism were also eye-witnessed (Fig.6, 7).

Table 1: Morphometrics of oothecae, eggs or compartments in each oothecae, number of hatchings and birth rate of *T. attenuata*.

Subject matter	Measurements
Length of oothecae	17.84 ± 0.49
Width of oothecae	11.92 ± 0.42
Eggs or compartments in each oothecae	351.2 ± 0.83
No of hatchings	232.8 ± 18.33
Birth rate%	71.23 ± 12.77

Table 2: Average temperature and humidity of six months.

Months	Maximum	Minimum	Humidity
May	37.20 ± 0.48	26.20 ± 0.47	62.0 ± 0.55
June	37.34 ± 0.49	26.80 ± 0.49	66.0 ± 0.71
July	38.78 ± 0.47	36.78 ± 0.47	80.0 ± 0.84
August	38.10 ± 0.43	30.92 ± 0.38	82.6 ± 0.55
September	37.44 ± 0.38	32.00 ± 0.47	66.8 ± 0.84
October	36.72 ± 0.26	23.80 ± 0.45	65.6 ± 0.54



Fig 1.



Fig 2.



Fig 3.



Fig 4.



Fig 5.



Fig 6.



Fig 7.

After hatching the nymphs were transferred in other glass cages (4 feet length, 2 feet width and height), in orders to keep away from cannibalism and provide space, where morphometrics measurement of nymphs after each molt, time period and feeding behavior documented. The first nymphal stage was measured about 11.00 ± 0.25 mm in length with a total duration of 12.6 ± 1.14 days; however, the fifth nymphal stage was measured about 57.10 ± 1.89 mm in length with a total duration of 53.2 ± 1.78 days (Table.3). Nymphs were appropriately supplied their prey which was collected from insect net. After each molt (shedding exoskeleton, nymphs becomes sluggish and for some time stop feeding), as the size of the nymph increases the consumption of the prey also increase. Period between 1st to 3rd instars has high mortality

rate but it decreases in 4th and 5th instars. Adult females have (six broad abdomen segments) long longevity than males, while males have (eight thin abdominal segments (Fig.8,9), and females were more pitiless eager prey feeder, spend more time in hunting and eating anything which come to into their approach but adult male become lazy and rarely hunting. Mating in *T. attenuata* eye witnessed in the daytime and it took two hours to complete and where it was also documented that female did not eat the male (Fig.10,11) after a few days one night, one of the female deposited its eggs within a foamy, light brown ootheca perched on fine mesh nylon cloths while other female perched ootheca in a glass house in the day time (Fig.12,13) it was noticed that the females after mating laid 1 to 3 time oothecae but first oothecae were

healthier than 2nd and 3rd. The oothecae laid over a few while they turned hard and become brown in color. Longevity of male 130.04 ± 3.44 days was observed and has undersized longevity while Female survived 165.4 ± 08.10 days and has elongated longevity than male. The morphometrics of five adults of each sex is given in (Table.4).

Table 3: Morphometrics of *T. attenuata*'s each nymphal stage length in (mm) and duration in (days).

Nymph stage	Measurements	Duration
1 st nymph stage	11.00 ± 0.25	12.6 ± 1.14
2 nd nymph stage	16.94 ± 0.46	18.0 ± 0.71
3 rd nymph stage	32.64 ± 0.54	26.4 ± 1.40
4 th nymph stage	42.50 ± 0.68	37.8 ± 1.30
5 th nymph stage	57.10 ± 1.89	53.2 ± 1.78

Table 4: Morphometrics of *T. attenuata* adult.

BP	MALE (mm)	FEMALE (mm)
TBL	79.98 ± 0.44	92.82 ± 1.81
LP	31.10 ± 0.54	35.06 ± 0.56
WP	04.18 ± 0.18	03.94 ± 0.27
LT	51.96 ± 0.40	53.10 ± 0.43
LC	13.94 ± 0.34	15.74 ± 0.28
LFF	17.78 ± 0.23	19.40 ± 0.38
LFT	07.88 ± 0.28	08.58 ± 0.29

Abbreviations: TBL, total body length. LP, length of pronotum. WP, width of pronotum. LT, length of tegmina. LC, length of coxa. LFF, length of fore femur. LFT, length of fore tibia.



Fig 8.



Fig 9.



Fig 10.



Fig 11.



Fig 12.



Fig 13.

4. Conclusion

The present study concluded that biology of *T. attenuata* is diversified. The size of the nymph is directly proportional to the consumption of the prey also increases. Highest mortality was recorded at 1st to 3rd instars. Mating in *T. attenuata* eye witnessed in the daytime and it took two hours to complete, however, it was also documented that female did not eat the male. Longevity of female was elongated as compared to male.

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